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Our readers and the public are informed, that an arrangement between the proprietors of this Magazine and the Mechanic's Institute, of this city, has been made, according to which, this Journal will become the organ of communication of that Society, publishing their proceedings, papers, &c., under the title of the "Mechanics' Magazine and Journal of the Mechanics' Institute."

The Magazine will hereafter be published, and sent to those *who may desire it*, in weekly parts.

By this arrangement we shall be able to render the work of increased value to our readers, and to lay before them such papers and lectures as may be read before the Mechanics' Institute—and judging from the series already delivered, this will be a great acquisition to our columns.

On our own part, we shall continue our endeavors to render the work of the highest interest and value to the Mechanic and Artisan.

No change in the mode of sending the work to its *present subscribers* will be made, unless specially requested.

Among recent scientific works, few have attracted so much attention, as Buckland's Bridgewater Treatise on Geology. Whether for the originality and forcible nature of the reasoning for the clear and neat diction, or for the elegant manner in which the work is published.

An edition has already appeared in this country, and from the fame of Prof. Buckland as a geologist, there is no doubt as to the rapid sale of the successive editions in this country and in Europe.

We have extracted the very clear and distinct description of the operation of Artesian Wells, for the benefit of our readers.

ARTESIAN WELLS.

FROM BUCKLAND'S BRIDGEWATER TREATISE—GEOLOGY AND MINERALOGY.

The name of Artesian Wells is applied to perpetually flowing artificial fountains, obtained by boring a small hole, through strata that are destitute of waters, into lower strata loaded with subterraneous sheets of this important fluid, which ascends by hydrostatic pressure, through pipes let down to conduct it to the surface. The is name derived from Artois (the ancient Artesium) where the practice of making such wells has for a long time extensively prevailed.*

Artesian Wells are most available, and of the greatest use, in low and level districts where water cannot be obtained from superficial springs, or by ordinary wells of moderate depth. Fountains of this kind are known by the name of ***Blow Wells***, on the eastern coast of Lincolnshire, in the low district covered by clay, between the Wolds of Chalk near Louth, and the sea shore. These districts were without any springs,

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* In common cases of Artesian Wells, where a single pipe alone is used, if the boring penetrates a bed containing impure water; it is continued deeper until it arrives at another stratum containing pure water; the bottom of the pipe being plunged into this pure water, it ascends within it, and is conducted to the surface through whatever impurities may exist in the superior strata. The impure water, through which the boring may pass in its descent, being excluded by the pipe from mixing with the pure water ascending from below.

until it was discovered that by boring through this clay to the subjacent chalk, a fountain might be obtained, which would flow incessantly to the height of several feet above the surface.

In the Kings well at Sheerness, sunk in 1781 through the London clay, into sandy strata of the Plastic clay formation, to the depth of 330 feet, the water rushed up violently from the bottom, and rose within eight feet of the surface. (Phil. Trans. 1784.) In the years 1828 and 1829 two more perfect Artesian Wells were sunk nearly to the same depth in the dock yards at Portsmouth and Gosport.

Wells of this kind have now become frequent in the neighborhood of London, where perpetual Fountains are in some places obtained by deep perforations through the London clay, into porous beds of the Plastic clay formation, or into the Chalk.*

* One of the first Artesian Wells near London was that of Morland House on the north-west of Holland House, made in 1794, and described in Phil. Trans London 1797. The water of this well was derived from sandy strata of the plastic clay formation, but so much obstruction by sand attends the admission of water to the pipes from this formation, that it is now generally found more convenient to pass lower through these sandy strata, and obtain water from the subjacent Chalk. Examples of wells that rise to the surface of the lowest tract of land on the West of London may be seen in the artesian fountain in front of the Episcopal palace at Fulham, and in the garden of the Horticultural Society. Many such fountains have been made in the town of Brentford, from which the water rises to the height of a few feet above the surface.

This height is found to diminish as the number of perpetually flowing fountains increases; and a general application of them would discharge the subjacent water so much more rapidly than it arrives through the interstices of the chalk, that fountains of this kind when numerous would cease to overflow, although the water within them would rise and maintain its level nearly at the surface of the land.

Important treatises upon the subject of Artesian Wells have lately been published by M. Hericart de Thury and M. Arago in France, and by M. Von Bruckmann in Germany. It appears that there are extensive districts in various parts of Europe, where, under certain conditions of geological structure, and at certain levels, artificial fountains will rise to the surface of strata which throw out no natural springs, and will afford abundant supplies of water for agricultural and domestic purposes, and sometimes even for moving machinery. The quantity of water thus obtained in Artois is often sufficient to turn the wheels of corn mills.

In the Tertiary basin of Perpignan and the Chalk of Tours, there are almost subterranean rivers having enormous upward pressure. The water of our Artesian Well in Roussillon, rises from 30 to 50 feet above the surface at Perpignan and Tours. M. Arago states that the water rushes up with so much force, that a Cannon Ball placed in the pipe of an Artesian Well is violently ejected by the ascending stream.

In some places application has been made to economical purposes, of the higher temperature of the water rising from great depths. In Wurtemburg Von Bruckmann has applied the warm water of Artesian Wells to heat a paper manufactory at Heilbrown, and to prevent the freezing of common water around his mill wheels. The same practice is also adopted in Alsace, and at Constadt near the Stutgardt. It has even been proposed to apply the heat of ascending springs to the warming of green houses. Artesian Wells have long been used in Italy, in the duchy of Modena; they have also been successfully applied in Holland, China,* and North America—By

* An economical and easy mode of sinking Artesian Wells and borinfor coal, &c., has recently been practised near Saarbirch, by M. Sellow. Instead of the tardy and

means of similar Wells, it is probable that water may be raised to the surface of many parts of the sandy deserts of Africa and Asia, and it has been in contemplation to construct a series of these Wells along the main road which crosses the Isthmus of Suez.

I felt it important thus to enter into the theory of Artesian Wells, because their more frequent adoption will add to the facilities of supplying fresh water in many regions of the earth, particularly in low and level districts, where this prime necessary of life is inaccessible by any other means; and because the theory of their mode of operation explain one of the most important and most common contrivances in the subterraneous economy of the Globe, for the production of natural springs.

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costly process of boring with a number of iron rods screwed to each other, one heavy bar of cast iron about six feet long and four inches in diameter, armed at its lower end with a cutting chisel, and surrounded by a hollow chamber, to receive through valves, and bring up the chips of the perforated stratum, is suspended from the end of a strong rope, which passes over a wheel or pully fixed above the spot in which the hole is made. As the rope is raised up and down over the wheel, its action gives to the bar of iron, a circular motion, sufficient to vary the place of the cutting chisel at each descent.

When the chamber is full, the whole apparatus is raised quickly to the surface to be unloaded, and is again let down by the action of the same wheel. This process has been long practised in China, from whence the report of its use has been brought to Europe. The Chinese are said to have bored in this manner to the depth of 1000 feet—M. Sellow has with this instrument lately made perforation 18 inches in diameter and several hundred feet deep, for the purpose of ventilating coal mines at Saarbirch. The general substitution of this method for the costly process of boring with rods of iron, may be of much public importance, especially when water can only be obtained from great depths.

From the Saratoga Sentinel.

HIGHLY IMPORTANT INVENTION.—ELECTRO MAGNETIC ENGINE.

In company with Dr. Steel and several other gentlemen, we called upon Messrs. Davenport and Cook, of this village on Saturday, with a view of examining the Electro Magnetic Engine invented by the senior partner.

The ingenuity, yet simplicity of its construction, the rapidity of its motion, together with the grandeur of the thought that we are witnessing the operations of machinery propelled by that subtle and all pervading principle electricity, combine to render it the most interesting exhibition we have ever witnessed.

Although we shall say something on the subject, it is perhaps impossible to describe this machine by words alone, so as to give more than a faint idea of it to the reader.

It consists of a stationary magnetic circle, formed of disconnected segments. These segments are permanently charged magnets the repelling poles of which are placed contiguous to each other. Within the circle stands the motive wheel, having the projecting galvanic magnets, which revolve as near the circle as they can be brought without actual contact. The galvanic magnets are charged by a battery, and when so charged, magnetic attraction and repulsion are brought into requisition, in giving motion to the wheel —the poles of the galvanic magnets being changed more than a thousand times, per minute.

Having in its construction but one wheel, revolving with no friction except from its own shaft, and from the wires connecting it with the galvanic battery, the latter of which can scarcely be said to impede the motion in any degree, the durability of this engine must be almost without limit.

There is no danger to be apprehended from fire or explosion: and we understand it is the opinion of scientific gentlemen who have examined it, that the expense of running this machine will not amount to one fourth as much as that of a steam engine of the same power.

From the time when the Greek philosopher supposed the magnet possessed a soul, its mysterious power has been regarded with increasing interest and attention to the present day. In addition to its utility in the compass, thousands have labored in vain at-

tempts to obtain through its agency a rotary motion. So intense has been the application of some to this subject, that in the attempt they have even lost that elevating attribute of our species, reason. It was reserved for Mr. Davenport to succeed where so many had failed.

He commenced his labors more than three years ago, and prosecuted them under the most discouraging and unfavorable circumstances—sustained by a constitutional perseverance and a clear conviction of ultimate success. He obtained the first rotary motion in July, 1834,; since which time he has devoted his whole attention to improvements in his machine. During this period it has passed through five different modifications, and is now brought to such a state of simplicity and perfection (having apparently the fewest possible number of parts) that the proprietors consider no further important alterations desirable, except in the due proportions of the different magnets, in which they are daily improving.

We were shown a model in which the motive wheel was $5\frac{1}{2}$ inches diameter, which elevated a weight of *twelve pounds*. And to illustrate the facilities for increasing the power of this engine, another model was exhibited to us with a motive wheel of eleven inches in diameter, which elevated a weight of *eighty-eight pounds*. Although these models have been for some time in progress, and we have occasionally been permitted to examine them, we have waited till the present period when the practicability of obtaining a rapid and unlimited increase of power seems to be placed beyond a doubt, before expressing an opinion, or calling the public attention to the subject.

If this engine answers the expectations of the inventor, (and we believe no one can assign a *reason* why it should not, it is destined to produce the greatest revolution in the commercial and mechanical interests which the world has ever witnessed. We may consider the period as commencing when machinery in general will be propelled by power concentrated upon the plan of this engine; when the vessels of all commercial nations will be guided to their point of destination and urged forward in their course by the same agent triumphantly contending against winds and tides, with the silent sublimity of unseen but irresistible power.

The prophetic ken of science is happily exhibited by Dr. Lardner, in his treatise on the Steam Engine. His far seeing geuius seems to have anticipated the invention of which we are speaking. "Philosophy," said he, "already directs her finger at sources of inexhaustible power in the phenomena of electricity and magnetism, and many causes combine to justify the expectation that we are on the eve of mechanical discoveries still greater than any which have yet appeared: and that the steam engine itself, with the gigantic powers conferred upon it by the immortal Waft, will dwindle into insignificance in comparison with the hidden powers of nature still to be revealed, and that the day will come when that machine, which is now extending the blessing of civilization to the most remote skirts of the globe, will cease to have existence except in the page of history."

From the integrity, perseverance, and mechanical skill of Ransom Cook, Esq., who has himself made an important invention in this engine, and has undertaken to bring the same into use, we anticipate a speedy introduction of its merits to the public. It is hoped that he may prove a second Livingston to another Fulton. He is about to depart for our large cities, in some of which he contemplates the erection of powers for mechanical purposes.

Several individuals, agents of Messrs. Davenport and Cook, are also departing with models to secure letters patent in the different countries in Europe and South America.

From the Pittsburgh Young Mens' Advocato.

NIGHT SIGNALS FOR STEAMBOATS.

There can be no other part of the earth where any improvement which when adopted will have a tendency to prevent collission between these vessels, than that of the great central valley of North America. If other neglect in our general Legislature did not remove our surprise, we might well be astonished at the palpable negligence of not legislating on Steamboat navigation.

Negligence of the general government in not providing a Code for Steamboat navigation. The propelling of vessels by steam is a new art—differing so much from any previous practised modes of moving vessels on water, as to most emphatically demand special, careful, and efficient legisla-

tion. The art again, has now been in operation an adequate length of time to put the public in possession of its leading principles both as to the benefits and defects. We present our readers with the subjoined as one step in advance.

NEW CODE OF NIGHT SIGNALS ON STEAMBOATS.

A new plan of signal lights for steamboats, to enable them to pass each other with safety at night, the invention of Captain W. D. Evens, of H. M. Packet Vixen, has recently been adopted in the Milford post office packets. Nautical men say, that it is the most efficacious of any of the many schemes hitherto proposed to prevent, or at least, to diminish the number of fatal accidents which occua by steamboats at night. It consists in placing a red light on the starboard bow, and a blue light on the larboard bow, with a common light on the fore-mast head. The effect of these lights, so placed, is to indicate immediately, to an observer, in the darkest night, the direction in which the vessel exhibiting them may be steering—which we understand, is all that is required generally to ensure safety; for it appears that most of the unfortunate accidents, which have occurred by steamboats running foul of each other in the night, were caused by each being ignorant of the others course. And, therefore, it is much to be regretted, that so simple and excellent a plan as this, has not long since been in operation;—by which many of those collissions so fatal to life and property might have been averted.

[Cork Standard.]

Items.

ST. PETERSBURG.—Within the three last years, this capital has extended itself greatly. New streets have been erected in various directions, in parts which were formerly quite beyond the boundaries of the city; and numerous other improvements are in the course of taking place; one of which is to convey an abundant supply of water from the Neva to all parts of the town. The works of the St. Isaac's Church are now proceeding with great rapidity, no fewer than three thousand men being employed on them daily during the present summer. Of the twenty-four granite columns (each of a single piece, 42 feet high) which are to adorn the exterior of the dome, fifteen are already erected, and the remaining nine have been prepared at the quarries. At present, the forest of scaffolding which surrounds the edifice renders it impossible to judge precisely what the effect will be; yet there is little risk in predicting that, when completed, it will prove the most stupendous architectural monument of modern times; not, indeed, altogether the rival of St. Peter's at Rome, as far as depends upon actual dimensions alone, but eclipsing it both in splendor of materials and in grandeur of style.—[Archit. Mag.]

THE GENERAL ARCHITECTURAL IMPROVEMENT OF LONDON.—We are happy to see that this subject is attracting the attention of Parliament; Mr. Alderman Wood has obtained a select committee to consider the propriety of a new street from Southwark Bridge to the Bank of England; another from Waterloo Bridge to the New Road; a third, from Lothbury to the Post Office; a fourth, from the Post Office to Smithfield; a fifth, from Holborn to the Strand; a sixth, through Southwark; a seventh, from St. Paul's to Blackfriars' Bridge; an eigth, from Oxford Street southwards; and a ninth, from Westminster Abbey to Belgrave Square. Sir Robert Peel hoped that an enlarged view would be taken of the subject, and that the house would not fall into the error it had committed with respect to railroads. Perhaps the best mode of proceeding with railroads would have been to appoint competent persons to survey the whole country, and to report upon the most eligible lines; but, though it was now too late to take that course, something of the same kind might be done, with a view to the contemplated improvements of the metropolis; and, before money of any kind were expended, some foresight ought to be used as to the future extension of London. If commissioners could be found, in whom the public would have confidence, for a rational and comprehensive plan, it would be a subject of much congratulation.—[Ibid.]

RECEIPT FOR FASTENING LEATHER UPON METAL.—A. M. Fuchs, of Bairere, says that in order to make leather adhere closely to metal, he uses the following mehod:—The leather is steeped in an infu-

sion of gall nuts; a layer of hot glue is spread upon the metal, and the leather forcibly applied to it on the fleshy side. It must be suffered to dry under the same pressure. By these means the adhesion of the leather will resist moisture, and may be torn sooner than be separated from the metal.—[Athenæum.]

Novel Experiments on Railways.—Since the opening of the Durham and Sunderland Railway, a novel experiment has been tried upon the line, which proves the practicability of railroad vehicles being propelled by wind. A temporary mast and sail were erected on a vehicle, which was set going at an easy rate. On the sail being trimmed to the wind, the speed increased to the rate of ten miles an hour. A train of five coal wagons was afterwards attached, but no additional sail hoisted. The train was set going as easy as possible to give it motion, when the speed increased to the rate above mentioned. The experiment was repeated for several days between Sunderland and Hendon, each way, with the same success, and was witnessed by numbers of spectators, who were much delighted with the novelty of the scene.—[Mining Jour.]

To prevent Milk from turning Sour.—Add to each quart of milk about 16 grains of bi carbonate of soda. It does not injure the taste of the milk, and aids remarkably the digestion of it. One of the large milk establishments of Paris has no other means of keeping the milk which remains, an advantage which is highly appreciated in large concerns of the kind.—[Jour. de Connais, Usuelles.]

Irradiation of Light.—It is a curious fact, that if the same letters of the same size precisely are painted on two boards, the one white on a black ground, and the other black on a white ground, that the white letters will appear larger, and be read at a greater distance, than the black. This is owing to what is called the irradiation of light. It depends on this, that the impression made on the bottom of the eye by bright objects extends a little wider than the actual portion of the organ struck by the light, and invading the space occupied by the darker objects, makes the brighter appear larger than they really are.—[Railway Mag.]

Discovery of Roman Remains.—A great many Roman remains have been recently discovered at Exeter; consisting, it is said, of a complete Roman city below the western market, which has been lately excavated and rebuilt on a grand scale. The relics prove the existence of the ancient Isca of Ptolemy and Antonius on this spot. They consist of more than 400 Roman Coins, of copper and silver, from Claudius to Valens; a very great quantity of the ancient red Samian pottery, sepulchral urns, amphoræ, pateræ, simpula, two curious lamps, lachrymatories, terracottas of great beauty, relating to mythological subjects, two sepulchral vaults, &c. The excavations are superintended by Captain Short, of Heavitree, who is considered an able and excellent antiquary.—[Mining Journal.]

The New Vehicle Retarder.—Much curiosity has been excited in Oxford by repeated trials of a new invention intended to regulate the speed of carriages when descending a hill, by means of which the coachman can instantly or progressively lock both the hind wheels. The apparatus was applied to a four-horse stage, which was loaded with passengers, and, on ascending or descending a hill, was found to answer all the purposes intended. The inventor then proposed that the coach should be taken down the hill without horses, and it was frequently stopped while proceeding at the rate of twelve miles an hour. Many practical gentlemen had ample proofs of the principle of the invention by having the coach lifted up, and the two hind wheels allowed to turn free on the axle, when it was found that a two-pound weight, placed on the extremity of the wheel, would gently bring it round; but when the first degree of retarding power was applied, it took a weight, so placed, of fifteen pounds to bring it gently round; the second degree, thirty-six pounds; the third degree, fifty-six pounds; and the fourth degree, three quarters of a hundred; but with this weight no one person was capable of moving either wheel on its axle. Mr. B. Pearson, organist of the city church, is the inventor.—[Oxford paper.]

Effect of the velocity of air upon its use in smelting Iron.—Mr. Teploff, one of the Russian mining corps, in an ar-

ticle on the improvements recently introduced into the smelting of iron in Russia, makes the following statement. In the smelting furnaces of the Ural, where the quantity and velocity of the blast are properly regulated, 1.4 of pig iron is obtained by 1 of charcoal fuel, while in other furnaces they obtain but .4 and .6 by the same consumption of fuel.

The velocity of the blast being increased, the heat within is increased, without a corresponding consumption of fuel. In an experiment made by order of the government, it was found that one hundred cubic feet of air, under a pressure of two inches of mercury, produced the same effect as two hundred cubic feet, under a pressure of one inch, with this difference, that in the latter case, twice the fuel was consumed which was required in the former case.

In one furnace which is mentioned, 22,000 lbs. of iron were obtained in twenty-four hours, by 16,000 lbs. of charcoal. Previous to the due regulation of the draught, they consumed twice this amount of fuel for the same yield of iron.

This economy is obtained by duly proportioning to each other the size of the blast-pipe, and the pressure of the draught. The relation of these to each other varies with the furnace.

M. Teploff asserts that the results thus obtained exceed those with the hot-air blast; but it does not appear that any comparisons have been made under his examination, and with the charcoal fuel.

To regulate the draught, it is recommended to place two mercury or water-gauges, one near the blast pipe, the other near the governor of the blowing-machine. By varying the pressure, and the diameter of the nozzle of the blast-pipe, making the latter smaller as the former is increased, and *vice versa*, the best proportion is to be ascertained.—[Annales des Mines, vol. vii.] G.

In Russia, during 1834, there were published 844 works, 728 of which were originals, and 116 translations. These last form about one-eighth of the whole, whereas, in 1833, the translations amounted to a sixth, and in 1831 to a fifth. The number of scientific works was 430, of which 359 were originals. Works purely literary were 271, and of these 226 were original. Of the whole amount 544 were in the Russian language, 91 in the German, 54 Hebrew, 46 Latin, 37 Polish, 36 French, 26 Lithuanian, Ethonian, Finlandish, and Swedish, 3 Italian, 3 Greek, 3 Samogitian, 1 Dutch, 1 English, 1 Arabic, and 1 Persian. At no period was the press of Russia more actively employed than it is at this moment.

TRANSACTIONS OF THE INSTITUTION OF CIVIL ENGINEERS.

A METHOD OF REPRESENTING BY DIAGRAM AND ESTIMATING THE EARTHWORK IN EXCAVATIONS AND EMBANKMENTS. BY JOHN JAMES WATERSTON, A. INST. C. E.

The object of this paper is to describe the construction of two sets of scales, by the use of one of which a section may be plotted, representaing the actual mount of material contained in any cutting or embankment, of the relation of which to each other a mere profile of the country, from not showing the contents of the side slopes, gives but an imperfect idea, even to professional men, particularly if the heights and depths be at all considerable, or if the slopes be not uniform; and by the other a computation of the quantities may be made, almost by the arithmetical process of addition only.

The principle on which the first operation is effected, is to accumulate the contents of the slopes x, x, into the rectangle y, over the middle part z in cutting, and under it in embanking, which is done by the formula $h = \frac{r}{B} H^2$, wherein B denotes the base or width of the excavation or embankment, as the case may be, H its depth, r the ratio of the slope, or of S to H, and h the height of the rectangle y, substituted in lieu of the slopes x, x. From this theorem, the scale shown on the drawing (plate No. III, fig. 1) is constructed, the heights H being marked on the vertical line m, and the supplemental heights h on the lines n, n, at right angles to it; and if a curve be drawn through the extremities of the latter lines, it will, as is evident from the equation, be a true parabola.

The scale thus constructed is used as follows. The axis being laid over the line of the railway, one leg of the dividers is

placed at the point where the perpendicular line *m* is intersected by the surface of the ground, and the horizontal distance to the curve being taken in the compasses, is set off vertically over the point of intersection. The scale is then moved along, the axis coinciding with the surface of the railway,* which is easily done in practice by running it on a straight edge, as shown on the plan, and the operation is repeated until a sufficient number of offsets being obtained, the line of section *a b c d* is drawn through them, and may be considered supplemental to the actual section of the ground *A B C D*, the superficies included between them representing what is due to the *slopes*, and that between the latter and the line of the railway what is due to the *middle*, while the product of the whole area, multiplied by the base or width of roadway, gives the total cubical content of the cutting or embankment. But the scale to be described presently, is better adapted for reducing the quantities to *figures*, the above being intended more to exhibit to the *eye* the true amounts of excavation and embankment, which, it is conceived, may be useful, especially in parliamentary investigations, in which the engineering evidence so frequently turns on such points.

In applying the scale to the case of canals, the process will be the same as in the foregoing, which has been described as for railways and roads, except that the line of supplimentary profile, instead of being referred to the line denoting the surface of the banks, must be plotted from a parallel line drawn below it, at a distance equal to the transverse area of the water channel divided by the width or base at that surface; and, indeed, in the cuttings for railways this will also have to be done to an extent, to allow for the ballasting. And with respect to an objection that may be taken to the number of the proposed scales it will be necessary to possess, in consequence of every combination of *original* vertical scales with width of base requiring one of them peculiar to itself, I would remark that though no doubt this is the case,* practically there is no very great variety in the scales commonly used by engineers and surveyors, or at all events the same individual generally adopts the same scales for the same purposes.

The scale shown on fig. 2 was suggested by my ingenious friend, Mr. Henry E. Scott, to whom it occurred as a modification of the above, which I had described to him. It is exceedingly simple, and the mode of using it almost self-evident. The ordinary section has only to be divided into equal lengths of say a chain, and the scale being applied to it at each point of division, with zero on the base line, the cubic quantity contained in that length on the given width and slopes is read off at the intersection with the surface of the ground; after which the content of the whole cutting or embankment is obtained by simply adding those figures together. The degree of accuracy that will be afforded must of course depend on the minuteness of the graduation, as all measurements with scales do; and if it appears impossible to go to *feet and inches* by this one, unless the section be very large, it should be borne in mind that the result given is final, and that (to say nothing of the liability to error in casting) any portion of inaccuracy that may be in it is not subject to increase by multiplication, which, if considered, may be found to affect to as great an extent quan-

* Strictly, the line *m* should be *vertical*, but, except where the heights and depths are great or the inclinations steep, the error from holding it perpendicular to the gradient is not of practical importance.

* If only the parabolic curve, and the tangential line *m* at its apex, be marked permanently on the scales, and the perpendiculars *n*, *n*, be traced on it as the occasion requires, one scale will be enough for every purpose, the division of the tangent *m* (by which, and the curve, the lines *n*, *n* are also determined) being effected by the use of the formula $H' = H\sqrt{\frac{lr}{B}}$, in which *H*, *r* and *B*, are the name as in the text, *l* is the latus-rectum of the parabola, and *H'* the point in the new graduation to be substituted for *H* in the original division; and one point being thus gained, all the others of course follow by equidistances. When the latus-rectum is large, the parabola is more obtuse, and the lines *n*, *n*, better defined.

tities calculated from the *primary* dimensions.

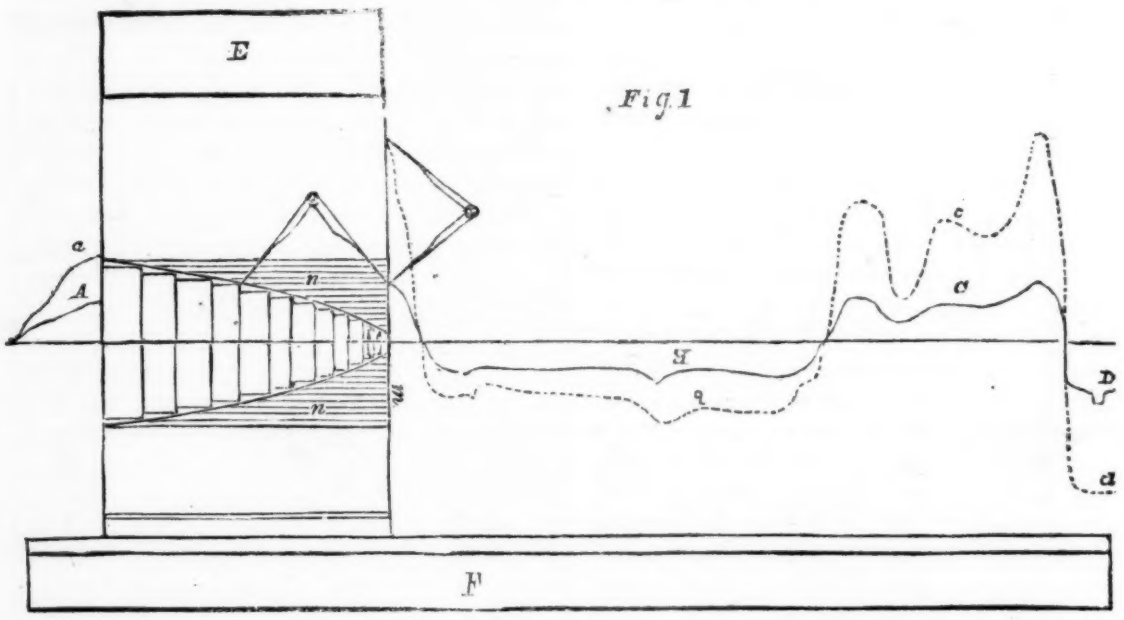
The construction of the scale is derived from the easily investigated formula $H = \sqrt{\frac{B^2}{4r^2} + \frac{9A}{r}} - \frac{B}{2r}$, in which A is the transverse area in square yards, the other letters expressing the same elements as before; or if Q denote the cubic content in yards, the equation $H = \sqrt{\frac{B^2}{4r^2} + \frac{9Q}{22r}} - \frac{B}{2r}$ is adapted for calculating the quantities in lengths of a chain each. This will give the total content, but as, when estimates are in progress, the angle the ground will stand at may not have been precisely ascertained, and perhaps have to be corrected afterwards, it is sometimes desirable to keep the slopes separate for a time from the middle or rectangular part, in which

Q = number of cubic yards.	I. Middle and Slopes together. $H = \sqrt{\frac{B^2}{4r^2} + \frac{9Q}{22r}} - \frac{B}{2r}$				II. Middle without Slopes. $H = Q \frac{9}{22B}$	III. Slopes without Middle. $H = \sqrt{\frac{9Q}{22r}}$			
	r					r			
	½	1	1½	2		½	1	1½	2
	H Feet.	H Feet.	H Feet.	H Feet.	Feet.	H Feet.	H Feet.	H Feet.	H Feet.
250	3.2	3.1	3.0	2.8	3.4	14.3	10.1	8.2	7.1
500	6.2	5.7	5.4	4.8	6.8	20.2	14.3	11.6	10.1
750	9.0	8.1	7.5	6.8	10.2	24.8	17.5	14.3	12.4
1000	11.4	10.2	9.3	8.6	13.6	28.6	20.2	16.5	14.3
1500	16.1	13.9	12.5	11.5	20.4	35.0	24.8	20.2	17.5
2000	20.4	17.3	15.4	14.1	27.3	40.5	28 6	23.3	20.2
2500	24 3	20.3	18.0	16.3	34.1	45.2	32.0	26.1	22.7
3000	27.9	23.1	20.3	18.4	40.9	49.6	35.0	28.6	24.8
4000	34.6	28.1	24.5	22.1	54.5	57.2	40.5	33.0	28.6
5000	40.7	32.6	28.2	25.3	68.2	64.0	45.2	36.9	32 0
6000	46.2	36.8	31.7	28.3			49.6	40.4	35.0
7000	51.4	40.3	34.8	31.1			53.5	43.7	37.9
8000	56.3	44.1	37.8	33.6			57.2	46.7	40.5
9000	60.9	47.5	40.5	36.1			60.6	49.6	42.9
10,000	65.3	50.7	43.2	38.3			64.0	52.2	45.2
11,000		53.7	45.6	40.5				54.8	47.3
12,000		56.6	47.9	42.6				57.2	49.6
13,000		59.3	50.3	44.6				59·7	51.4
14,000		62.0	52.5	46.5				61.9	53.5
15,000		64.7	54.7	48.4				64.0	55.4
16,000			56.7	50.2					57.3
17,000			58.7	52.0					59.1
18,000			60.7	53.7					60.8
19,000			62.6	55.3					62.4
20,000			64.5	56.9					64.0
21,000				58.5					
22,000				60.1					
23,000				61.6					
24,000				63.0					
25,000				64.4					

case the scale may be conveniently graduated on the one edge for the middle portion by $H = Q \frac{9}{22B}$, and on the other, for the slopes, by $H = \sqrt{\frac{9Q}{22r}}$. The above table has been constructed by way of specimen from these formulæ, and shows the heights which, measured on the scales, give the points corresponding with the cubic quantities in the first column, the length in all cases being taken as one chain, the width or base as thirty feet, and the slopes as stated;

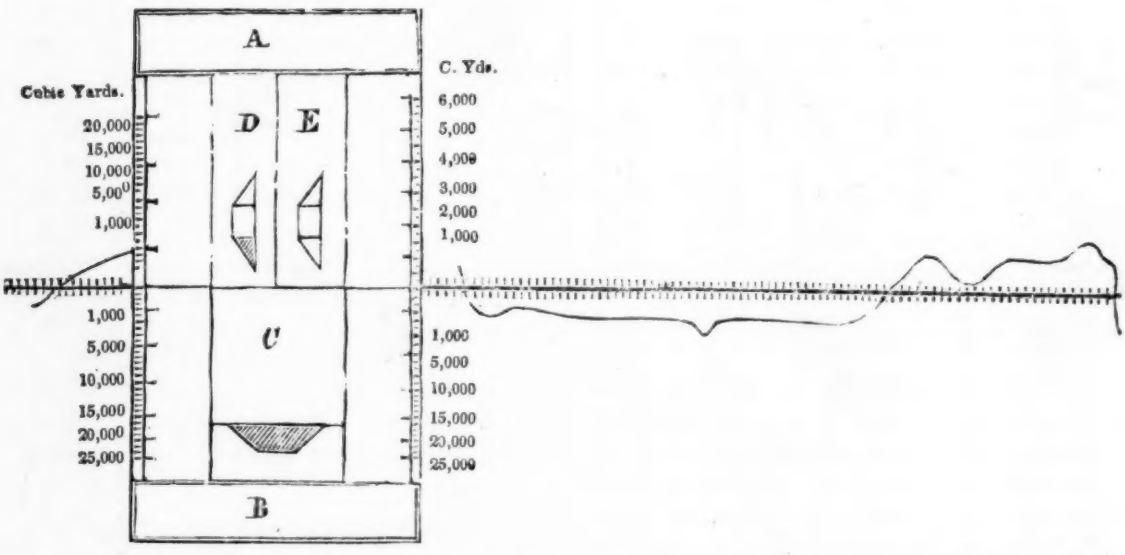
Plate 3.

Fig. 1



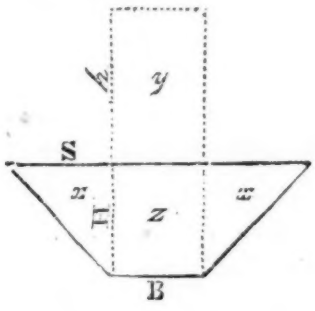
E, Vertical Scale 200 feet to 1 inch, Base 30 feet, Slope 1½ to 1. F, Straight edge.

Fig. 2.



A, Vertical Scale 100 feet to 1 inch, Base 30 feet, Slope 1½ to 1. B, Quantities given in cubic yards for lengths of 1 chain. C, Middle and Slopes together. D, Slopes without Middle. E, Middle without Slopes.

but the quantities for other lengths, widths, and slopes are, as I need hardly say, in the simple proportion of the variation in any one of the dimensions.



The following letter from William Norris, Esq., of Philadelphia, will be read with much interest by those who have read the account of the performance of his Engines.

PHILADELPHIA, April 3d, 1837.

Messrs. MINOR & SCHAEFFER—

Gentlemen,—I received in due time your Railroad Journal, of March 11, containing a letter from A. G. Steere, Esq., of the New-York and Erie Railroad—and until this moment, press of business and unavoidable absence from home for the last week, have prevented my replying to the same.

To Mr. Steere's remarks, I reply, that, however wonderful such performances may seem to him, they are nevertheless all *substantially true*, and can be authenticated by the affidavits of scientific men, of the first eminence for talents and integrity.

Mr. Steere has based his calculations on previous theories, and seems determined to adhere to them, without admitting a probability of a change as science advances. He must then believe that Pambour has firmly established a Theorem forever, and that all the results of scientific experiments, from this date, as regards traction, friction, &c. &c., must be (to be true) in accordance with the formula so laid down. This is preposterous.

I am well aware, that the performances of my Engines, in giving results 50 per cent. better than any other, have created surprise, and in some instances doubt, but I can prove by disinterested persons of *well known* integrity, the facts of every performance, as detailed in my Circular, and I can appeal to yourselves, (Messrs. Minor & Schaeffer,) and also to 51 other gentlemen, as witnesses of the experiment of 19th July last. There was no mistake, no deception there.

In the course of this communication, I shall record some experiments still more wonderful, that are also FACTS, and which will stagger Mr. Steere's belief still more, in the possibility, or PERHAPS PROPRIETY, of abolishing old Theories.

During the last summer, when the Stationary Engine was out of order and under repair, the George Washington Engine, for about 27 days, performed all the duties required on the Plane—and in one instance, for 5 days in succession, the mode of operation was thus, viz:—At the foot of the Plane, two cars would be attached to the Engine, which, with the Tender, seldom weighed less than 26,000 lbs. This load was then dragged to the summit in from 2 to 3 minutes. The cars were then detached, and the Engine secured to the rope, while at the foot and on the other track, 5 or 6 cars were likewise attached to the rope—the Engine would then be put in operation, descending the Plane, and dragging up by the rope, the cars so attached. The greatest weight dragged up in this way was 47,450 lbs.

Another of my Engines, the "Benjamin Franklin," has been, during the winter and spring, also performing the duties required of the Stationary Engine.

On the 16th ultimo, I put on the road two new Locomotives, built for the State of Pennsylvania, viz:—The "James Madison" and "La Fayette," both these Engines ascended the Plane with loads. On the afternoon of the same day, the La Fayette dragged up the Plane 38,000 lbs.—

When about half way up, from 50 to 60 persons, from the crowd that had stationed themselves at that point to witness the experiment, jumped on the cars, and for a moment impeded her progress, (the wheels slipping,) but as soon as she was relieved of this extra load, she ascended to the top, and immediately descended with the two cars, stopping at pleasure in the descent. In consequence of the late hour, no further trial was made that afternoon. This performance was witnessed by 200 gentlemen, many of Science, amongst whom was Capt. Tallcot, of the New-York and Erie Railroad.

On the 18th another trial was contemplated, and for this purpose, two cars were loaded with Pig Metal and weighed, but on arrival at the foot of the Plane, a drizzling rain commenced, and soon formed a slimy coat on the rails—which were then in the worst possible condition. The two loaded cars were detached and the Engine sent up the Plane with the Tender, the weight of which loaded, was upwards of 10,000 lbs., and notwithstanding the bad condition of the rails, the Engine drew up this load in the very short space of 1 min. 40 seconds. This performance was also witnessed by Capt. Tallcot.

A third trial was deferred (in consequence of the derangement of the regular business on the Plane during the experiments) until the arrrival of Judge Wright, of New-York, at whose request the foregoing experiments were projected, he having been detained from them unexpectedly. A letter was received from the Judge last week, during my absence, informing of his arrival at, and departure from Philadelphia, but stating his intention of remaining in Philadelphia on his return, for the purpose of witnessing the experiments—and it would give me great pleasure to have Mr. Steere's company at the same time, to prove to him that old Theories MAY be abolished. When this trial takes place, Judge Wright shall superintend the weighing of the Engine, Tender, and load—shall take the measurements of the safety valve and lever, to ascertain the pressure—shall leave the whole matter under his absolute control, and when the result is published, I hope Mr. Steere will then admit that there is something *new under the* sun.

The La Fayette is performing daily on the Columbia Railway, and any persons can, at any time, see for themselves, the immense powers of this Engine. She drags with ease 25 loaded cars, over abrupt curves and high grades, and on a rise of 52 feet per mile, with the actual weight of 241,275 lbs. (taken from the Weigh Masters' Books) attached to her. she has come to a dead stand, and started again without the least difficulty from a state of rest. On Friday last, March 31st, this Engine brought in attached to her, the unprecedented and enormous load of 45 cars, 25 of which were loaded, and this load she carried over the grade of 52 feet rise per mile, without any difficulty, not a single instant's delay, but steadily at the rate of nearly nine miles per hour. Let unbelievers come and see for themselves.

The dimensions of La Fayette are as follows :—

Whole weight	18,725 lbs.	Including water and fuel while in operation on the road.
Weight on drivers	11,375 "	

Diam. of Cylinders, 10½ inches,
Length of Stroke, 18 inches.

I am, Gentlemen, very respectfully,
Your obedient servant,
WILLIAM NORRIS.

POSTSCRIPT.

PHILADELPHIA, April 4, 1837.

Gentlemen,—Will you please add to the performances of the La Fayette Engine, the following :—

On Saturday last, (1st instant,) she took out the enormous load of 332,330 lbs. be-

hind her, exclusive of weight of Engine and Tender—the weight is given me by the Weigh Master.

Yours very respectfully,

WILLIAM NORRIS.

ON THE RETARDATION OF THE VELOCITY OF STEAMBOATS IN ASCENDING RAPIDS. BY M. R. STEALEY, CIV. ENG., FRANKFORT, KY.

It is a well ascertained fact, that a steamboat having a given power, capable of propelling at a certain maximum velocity on still water, cannot ascend a rapid where the velocity of the current is nearly equal to the speed attained on still water, and that the progress of the boat in ascending a rapid added to the velocity of the current, is not as great as the velocity of the boat on an expanse of water void of motion; and consequently, that the speed of the boat in stemming a current, is retarded in a greater ratio than the opposing velocity of the current would seem to indicate—there is then evidently some new opposing or retarding force to be encountered in ascending a rapid, in addition to that of the current; and it is believed, that the greater part, if not the whole of this force, is attributable to gravity.

In elucidation of this position, it may be observed, that when there is motion in the water occupying the channel of a river, there is also a proportionate descent in its surface in the direction of that motion, or current; one is a necessary consequence of the other, each being to some extent modified by local causes. It will then be perceived, that the surface of water running in an open channel assumes the form of an inclined plane, upon which, when a boat ascends, it not only encounters the resistance of an opposing current, but also that which gravity opposes to the ascent of bodies on inclined planes.

Having all the necessary data given, it would be easy to calculate the amount of power, necessary to overcome the gravitating force of a body on an inclined plane, by the ordinary formula, applicable to the motion of bodies on stationary planes.—The surface of a rapid, however, is not a *stationary*, but a *moveable*, plane; and it becomes necessary from this cause, to adopt an essentially different method of calculation from the forms, in order to arrive at the true result. And it may be observed, that the omission to draw this distinction between stationary and moveable planes, has heretofore been the cause of underrating the resisting force under consideration. If a body moving on a fixed plane, possesses sufficient power within itself, to propel it along the plane, at a given velocity, the amount of power expended by the body, is precisely the same as would be expended, when the plane moves with the same velocity in an opposite direction, and the powers of the body is exerted in maintaining a fixed position in reference to any stationary object beyond the plane. And generally, the resistance to the motion of a body traversing a plane, and the power expended in order to overcome that resistance, should be estimated by the resistance which the body traverses on the plane, whether the latter is moveable or stationary.

It will be readily perceived from the preceding remarks, that in the case of a steamboat ascending a rapid, an instance presents itself when the plane is moveable, and the body by its inherent power exerts a force to pass along that place. For the sake of illustration, we will assume a rapid, the ratio of inclination of which is 1 foot in 500, with an uniform velocity of 500 feet per minute. On such a current, a body left to itself, would be carried down 1 foot of perpendicular height, in each minute of time. Now, if this body can exert a force capable of moving itself up this plane, at a relative velocity equal to the velocity of the

plane or current,—the body will then be stationary in reference to any *fixed object on the shore;* but it is evident, that at the end of each minute, it will be in a position on the plane *one foot higher*, than the position it occupied on the plane at the beginning of the minute, because by the hypothesis, the current would have descended through that perpendicular height in this space of time. Here then are two forces acting in opposition to each other. One, the current exerting a force equal to taking the body downward through one foot in one minute, and that exerted by the body in maintaining a stationary position; the latter counteracting the former they are in equilibrio, and consequently equal—and, therefore, although the floating body or boat has *actually* remained stationary, it has *virtually* expended power sufficient to have raised itself through one foot of perpendicular space in one minute of time.

The power expended therein, overcoming the force of gravity on moveable planes or currents, should be estimated, not by the *actual* height to which the floating body of boat is elevated, as ascertained by reference to some fixed object beyond the plane, or on the shore; but by the virt al *height measured on the plane itself;* and this, for any given time, will be estimated by the relative distance traversed, and the perpendicular elevation due to that distance by the ratio of the inclination of the plane.

Let W = weight of the boat in tons.
V = virtual velocity of the boat per minutes.
H = Height of the plane.
L = Length.
T = Time of ascent.

(15 = No. of tons raised 1 foot high in 1 minute equal to 1 horse power) and N = No. of horse power necessarily exerted at each instant of time, to overcome the graviting force, and A = the aggregate mechanical force expen ded in the time T expressed in horse power acting for 1 minute.

$$-\frac{W\ V\ H}{15\ L} = N.$$

or making J the inclination of the plane, we have

$$\frac{W\ V\ (\text{sin. } J)}{1\ 5} = N. \text{ and } N\ T = A.$$

In the foregoing investigation, the current is assumed to have uniform velocity; when the rapid is long and deep, however, the velocity of the current will be accelerated. The greater the depth of water on the rapid, and the more direct its course, the nearer the accelerated motion will approximate to the velocity assigned by theory to the motion of a body rolling down an inclined plane—and the less the depth of water, and the more sinuvus the channel, the more closely the current will approach to an uniform velocity. In fine, the accelerating force is so much dependent on, and modified by local circumstances, that no formula admitting of general application, can be given, from which the accelerated velocity can be deduced, and it can therefore only be ascertained by observation. When the motion is accelerated, the formula above given can be applied, by dividing the rapid into sections, considering each separately, and thence deducing a general result.

From the Pittsburgh Working Mens' Advocate.

TRADE OF THE CENTRAL PARTS OF THE UNITED STATES.

Few persons, even amongst those most interested, unless they have very carefully attended to the ranges of the river vallies on each side of the Appalachian system of mountains, can have formed an adequate idea of the peculiarly advantageous position of Pittsburgh. But from some recent evidence we are inclined to believe that more correct views have been taken of the commercial value of this city, in New-York, than has been taken in Philadelphia.

TRADE OF THE WEST.

The favorable position of Baltimore, in reference to the trade and intercourse with the West, is strikingly exemplified in the

following paragraph from the New-York Express:

"There is a plan on foot for organizing a Steam Freighting Company, the object of which is to transport goods from this city to Baltimore. It is stated that goods could be shipped by this route and reach Pittsburgh in one hundred hours. This would be an immense thing for the West. The plan is already before the Legislature of this State for a charter."

The preceding was cut from a Baltimore paper, we now place it before those most concerned. The Baltimore editor says—"This will be an immense thing for the West." So it would, but it would be a much more vast thing for the EAST. By a calculation on data, we boldly say of the soundest kind, there will in 1850 exist within that part of the United States westward of the great Appalachian system of mountains upwards of thirteen million of inhabitants. It will, of course be a boon of no small value for any city to be the principal Atlantic depot or emporium for the trade of such regions. This is a subject we shall take care not lose sight of, but at present we confine ourselves to Pittsburgh.

Few who have heard the name of this city, but who know that it occupies the ground around the junction of the Monongahela and Allegheny rivers, but comparatively few are acquainted with the remarkable features of these two streams. The Allegheny has its remote sources in New-York at N. lat. 42° 20′, and with large inflections but with a general course a very little west of south, and receiving most of its tributary waters from the eastward and from the mountains.

The Monongahela has its highest sources in Virginia, at about N. lat. 38° and 40′, and pursuing so nearly a due northern general course, that a meridian line passing through Pittsburgh, passes also very nearly over the extreme fountains of this river.

From the preceding elements it is seen that the two constituent streams which form the Ohio river at Pittsburgh, flow almost directly towards each other. It may be here remarked, that the mountain structure by no means terminates with those most prominent ridges or chains to which by pre-eminence has been given the title of mountains: and again, that the streams, particularly in Pennsylvania, Maryland and Virginia, which rise in the Appalachian valleys, as soon as they assume the size to deserve the name of rivers, flow either along those valleys or almost at right angles to them. Any person may satisfy themselves of the correctness of these remarks by examining on a map the general course of the Delaware, Susquehanna, Potomac, and James rivers. In none, however, of those Atlantic streams are these features in physical geography more striking than in the general courses of the Allegheny river. At their junction the united streams under the name of Ohio apparently continues the general course of the Monongahela, which is not by any means the case. The general course of the latter river from its source to the mouth of Turtle Creek, eight miles above Pittsburgh is maintained, but here in obedience to the natural laws of the rivers of this region it inflects to North-West, at right angles to the general range of the mountains, and pursuing that course joins the main branch and the now combined volume piercing a real chain of the Appalachian continues a northwestern direction to the influx of Beaver river, below which it gradually curves until assuming the general course of the principal constituent stream, the Allegheny, flows upwards of one hundred miles very nearly parallel to the Monongahela, but in a directly opposite course.

From the sources of the Monongahela to within eight miles of its mouth, the distance between it and Ohio is about a mean of fifty miles, and the intermediate space traversed nearly centrically by a ridge, which though not usually regarded as such, is in fact an Appalachian spine, which is again continued between the confluents of Allegheny and Beaver. The city of Pittsburgh therefore, occupies a position in one of the river passes, and the only deep gorge in existence from the mountain into the interior of the continent between the sources of the Allegheny to those of the rivers which contributed to form the Mobile and Appalachicola.

In fine, examining the combined features of this projection, with the relative geography of the whole region in which it is situated, it may at once be pronounced as unequalled. It is remarkable, that in the struggle between Philadelphia and Baltimore for the western commerce, Pitts-

burgh may remain tranquil as regards the contest. Let the Atlantic emporium be on the Delaware, or on the Chesapeake, or Potomac, or let emporia be formed on all these, which must indeed be the case, still the Ohio at Pittsburgh must receive the largest share of the transit commerce.

Again, the advantages of this remarkable position, are not to be bounded by the Ohio trade, as it is just as completely secured by nature to form a point on the great line of lake trade, as it is for that of the Mississippi basin. Let this line be completed by whom it may, and let its Atlantic termination be where it may, the line will follow the great gorge of the Ohio from Pittsburgh to Beaver, and thence by the latter, and thence to Cleaveland.—Those who are most ready to follow the suggestions of nature will profit most, and let it be known to all whom it may concern —that the laws of nature are like those of the Medes and Persians.

Steam Carriages on Common Roads.—A committee of the British House of Lords have, by their report to the House, objected to the reduction of prohibitory tolls on such carriages; on the ground of the danger in frightening horses, of setting fire to buildings, &c., of the greater skill required to manage such locomotives than those on railways; and more especially from the opinion that such enterprises can not become profitable to those who engage in them, and that, therefore, any encouragement on the part of the Legislature would only give rise to wild speculations, ruinous to those who pursue them. G

Copper Ore raised in Cornwall.—The quantity of copper ore raised at about eighty mines in the county of Cornwall, during the past twelve months, was 140,981 tons of 21 cwts., the average produce of which was 8¼, giving 11,639 tons 11 cwt. of copper; the average price for the ore was £6,17 per ton, amounting to £957-752,86. With three or four exceptions not one of these mines belong to a public company.

Mining in Cornwall.—The steam engines now at work in the mines of Cornwall, are equal in power to at least 44,000 horses. One bushel of coal does as much work as sixteen bushels did in the earlier stages of the employment of steam power. —[Newton's Jour.]

Aeronautic Observations.—Mr. Green, who recently ascended in a balloon with Lord Clanricarde, observed that surveyors and architects could with greater facility take plans of noblemen's estates by ascending in a balloon, as they could have a bird's-eye view of every locality, and if they only once adopted that method they would never relinquish it. Since the suggestion, an artist named Burton called on Mr. Green to obtain from him the plan of a balloon constructed so as to act in the above way, it being connected to the car by a swivel. The inventor proposes to build a wagon, for the purpose of fastening a balloon to it, which, when filled with gas, which can be done in various parts of the country at gas company's gasometers, may be conveyed to any place a surveyor requires, where, on a calm day, he can take plans, carrying with him the proper instruments. The balloon will then be fastened by ropes to the spot most favorable for observations, and raised to an elevation of 300 or 400 feet, as necessary. In this way a bird's-eye view can be taken of any town or city. Mr. Green is willing at any time that his balloon, by way of experiment, may be made use of in that way.—[Lond. Mech. Mag.]

New Surveying Instruments.—M. Lalanne, Engineer of the *Ponts et Chaussees*, in France, has laid before the *Academie des Sciences* three instruments for typographical surveying, which, if they accomplish all that the inventor promises, correctly and with facility, will be eagerly sought after. To the immense number of surveyors, who are about to commence operations in every part of the United Kingdom, under the numerous Railroad Acts which have passed this session, such instruments would be invaluable. They are, 1st, a Levelling Instrument, or Carriage, which it is only necessary to run over the ground, the levels of which are desired, and the section is at once obtained; 2nd, a Drawing Instrument, which lays down the plan of the ground; and can be mounted on the carriage of the Levelling Instrument; 3rd, a Power-measuring Instrument, or Dynamometer, which exhibits the effort exerted on every point of the line passed over.—[Mag. Pop. Science.]